



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
BIN C15700
Seattle, WA 98115-0070

August 6, 2003

MEMORANDUM FOR: F/NWO - D. Robert Lohn, Regional Administrator

FROM: F/NWR4 - Steven W. Landino, Washington State Director

SUBJECT: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for issuance of 10(a)(1)(A) enhancement of survival permit to Fish First for restoration activities in the Lewis River Watershed,(Section 10(a)(1)(A) Permit). NMFS Tracking No.: 2003/00422

Enclosed is a document containing a biological opinion (Opinion) prepared by NOAA's National Marine Fisheries Service (NOAA Fisheries) pursuant to section 7 of the Endangered Species Act (ESA) on the effects of the proposed issuance of 10(a)(1)(A) enhancement of survival permit to Fish First for restoration activities in the Lewis River Watershed, WRIA 27, Clark County, Washington. In this Opinion, NOAA Fisheries concludes that the proposed action is not likely to jeopardize the continued existence of ESA-listed Lower Columbia River (LCR) steelhead trout (*Oncorhynchus mykiss*), LCR chinook salmon (*O. tshawytscha*), and Columbia River (CR) chum salmon (*O. keta*). As required by section 7 of the ESA, NOAA Fisheries includes reasonable and prudent measures with nondiscretionary terms and conditions that NOAA Fisheries believes are necessary to minimize the impact of incidental take associated with this action.

This document contains a consultation on Essential Fish Habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and its implementing regulations (50 CFR Part 600). NOAA Fisheries concludes that the proposed action may adversely affect designated EFH for chinook and coho (*O. kisutch*) salmon. As required by section 305(b)(4)(A) of the MSA, included are conservation recommendations that NOAA Fisheries believes will avoid, minimize, mitigate, or otherwise offset adverse effects on EFH resulting from the proposed action. As described in the enclosed consultation, 305(b)(4)(B) of the MSA requires that a Federal action agency must provide a detailed response in writing within 30 days of receiving an EFH conservation recommendation.

If you have any questions regarding this memo, please contact Stephanie Ehinger of my staff in the Lacy Branch Office at 360-534-9341.



**Endangered Species Act-Section 7 Consultation
Biological Opinion
and
Magnuson-Stevens Fishery Conservation and Management
Act
Essential Fish Habitat Consultation**

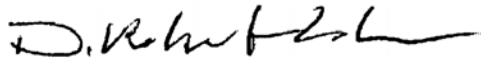
**Issuance of Section 10(a)(1)(A) ESA Permit # 1425
to Fish First
Lewis River
Clark County, Washington**

NOAA Fisheries Tracking No.: 2003/00422

Action Agency: National Marine Fisheries Service

Consultation Conducted By: National Marine Fisheries Service
Northwest Region
Washington State Habitat Branch

Issued by:



D. Robert Lohn
Regional Administrator

Date Issued: August 7, 2003

Expiration Date: October 31, 2007

TABLE OF CONTENTS

1.0 INTRODUCTION	1
1.1 Background and Consultation History	1
1.2 Description of Proposed Action	1
1.2.1 Fish Passage Restoration	3
1.2.2 Obliteration of Old Roads and Stream Crossings	3
1.2.3 Riparian Enhancement	3
1.2.4 Reconnecting Off-Channel Habitat	3
1.2.5 Nutrient Enhancement	4
1.2.6 Placement of Large Woody Debris	4
1.2.7 Supplementing Spawning Gravel	4
1.2.8 Creating In-Stream Habitat	4
1.2.9 Additional Conservation Measures	5
1.3 Description of the Action Area	7
2.0 ENDANGERED SPECIES ACT BIOLOGICAL OPINION	8
2.1 Evaluating Proposed Actions	8
2.1.1 Biological Requirements	9
2.1.2 Environmental Baseline	9
2.1.3 Status of the Species	10
2.2 Effects of the Proposed Action	13
2.2.1 Direct Effects	14
2.2.2 Activity Specific Effects	22
2.2.3 Indirect Effects	28
2.3 Cumulative Effects	29
2.4 Conclusion	29
2.5 Reinitiation of Consultation	30
3.0 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT	30
3.1 Background	30
3.2 Identification of Essential Fish Habitat	31
3.3 Proposed Actions	32
3.4 Effects of Proposed Action	32
3.5 Conclusion	32
3.6 Essential Fish Habitat Conservation Recommendations	32
3.7 Statutory Response Requirement	32
3.8 Supplemental Consultation	32
4.0 REFERENCES	34
Appendix A - General Permit Terms and Conditions	37

Appendix B: Regression Graph \log_{10} NTU vs \log_{10} SS	39
Appendix C: Average Severity of Ill Effect Scores Matrix from Newcombe and Jensen, 1996	40
Appendix D: Suspended Solids East Fork Lewis River at Dollar Corner	41

1.0 INTRODUCTION

1.1 Background and Consultation History

On January 29, 2003 Fish First (FF) applied for a permit under section 10(a)(1)(A) of the Endangered Species Act (ESA) for habitat activities designed to enhance the survival of ESA listed salmonid populations in the Lewis River basin in the state of Washington. Fish First is a 501(c)(3) non-profit organization created to aid in the recovery of salmonid populations.

On April 2, 2003, NOAA Fisheries published a notice in the Federal Register (FR) that it had received an application for a scientific research and enhancement of survival permit, 10(a)(1)(A). During the 30-day comment period, five comments were received. They have been addressed by the applicant, incorporated into the underlying action, and analyzed in this document.

NOAA Fisheries must consult under the ESA (16 U.S.C. 1531 *et seq.*) and under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1851 *et seq.*). The objective of an ESA Biological Opinion (Opinion) is to determine whether a Federal action (here, the issuance of a 10(a)(1)(A) permit for the proposed enhancement activities) is likely to jeopardize the continued existence of listed species. On a finding of no jeopardy, the issuance of a 10(a)(1)(A) permit would be published in the FR.

The objective of Essential Fish Habitat (EFH) consultation is to determine if a Federal proposal may adversely affect EFH. The species covered by this Opinion are Lower Columbia River (LCR) steelhead trout (*Oncorhynchus mykiss*), LCR chinook salmon (*O. tshawytscha*), and Columbia River (CR) chum salmon (*O. keta*). The species considered in the EFH consultation are chinook and coho (*O. kisutch*) salmon.

1.2 Description of Proposed Action

NOAA Fisheries proposes to issue a section 10(a)(1)(A) enhancement of survival permit to FF for approximately 29 projects that fall into the following eight categories: Fish passage restoration, obliteration of old roads and road crossings, riparian enhancement, reconnecting off-channel habitat, nutrient enhancement, placement of large woody debris (LWD), supplementing spawning gravel and creating in-stream habitat. While undertaking these projects FF biologists may need to capture, handle, and release listed fish, in some cases using backpack electrofishing gear. Detailed descriptions of these activities are provide below. The proposed permit is for five years and will expire on or before August 10, 2008.

FF's projects are designed for the sole purpose of enhancing salmon survival in the Lewis River basin. All projects will be undertaken on private property and in stream reaches below U.S. Forest Service land. The activities proposed will enhance or restore natural aquatic or riparian habitat processes or conditions, selectively alter degraded habitat features to improve habitat conditions, and address habitat factors that limit salmon production and survival. Fish First's projects include long-term, self sustaining projects (like replanting riparian areas) as well as

short-term measures (like constructing in-stream structures), and will restore natural processes to the maximum extent possible. The short-term measures will provide immediate salmon habitat functions where needed to bridge the gap until natural processes start to function.

First, FF prioritizes potential projects by cost to benefit considerations grounded on the basic principles of stream restoration. Fish First is aware of the importance of a watershed approach to achieve recovery of stocks as discussed in Roni *et al.* 2002. Enhancement of survival projects are more likely to be successful if undertaken with supporting analyses that disclose existing habitat impairments. Without the context provided by watershed analyses, enhancement efforts are likely to focus on site-specific symptoms rather than on the underlying impaired ecosystem processes (July 10, 2000, 65 FR 42448).

Second, FF uses a panel of interdisciplinary experts to plan and design projects. This provides them with the means to address biological as well as physical aspects of enhancement.

Third, FF aims to educate the cooperating landowners on principles and practices of restoration to be able to design holistic projects, that include the surrounding upland as well as the immediate stream channel. During the design process FF utilizes a number of avenues to develop immediate and long-term public support. Among these vehicles are regular newspaper articles, articles in national fishing magazines, regular project tours for other enhancement organizations, various government agencies, schools and other interested parties.

NOAA Fisheries will require FF to monitor all projects and provide annual reports in the form and as specified in the permit. In general FF will monitor construction activities including down stream sedimentation, the integrity of structures, vegetation survival, effects on fish, and report numbers of fish that are injured and killed. Fish First will also provide project details as requested by NOAA Fisheries.

As part of the application, FF submitted a list of 29 projects they are planning to construct within the next five years. Twenty-two projects are proposed to be on the East Fork Lewis River or its tributaries, five are proposed on Cedar Creek, and two are proposed on Hayes Creek. Fish First expects to dewater stream sections during construction of five projects. Fish First may undertake projects not listed among the 29 potential projects if they fall within the categories listed below and meet permit conditions. Fish First must provide prior notice to NOAA Fisheries when undertaking a project not in the present list.

Below is a description of the eight categories of activities proposed included in the proposed permit. Each of the projects includes one or more of these nine activities. Each proposed category of activity includes conservation measures designed to limit the impact on listed salmon and their functioning habitat.

1.2.1 Fish Passage Restoration

The objective of restoring fish passage is to provide salmonid access to historic habitats from which they have been excluded by man-made structures. Fish passage restoration would include culvert replacement, culvert removal, bridge removal, step-pool transitions, and fish ladder construction. It would not include removal of debris jams, sediment bars, or beaver dams which in rare instances can act as temporary salmonid passage barriers. Work is proposed to take place in accordance with “Removal of Fish Passage Barriers at Stream Crossings by Roads, Levees, and Dikes” (NOAA Fisheries, October 29, 2001 as amended). In addition to conservation measures listed therein every project would be constructed incorporating all conservation measures listed below under section 1.2.9. Presently, FF has planned to replace a maximum of ten culverts and two concrete mini-dams for the next five years (projects number 4, 13, 23, and 25 on the FF project list).

1.2.2 Obliteration of Old Roads and Stream Crossings

The objective of removing old roads and stream crossings is to restore and rehabilitate the riparian corridor and to reduce the number of stream crossings. Fish First works with land owners on private properties. Thus, the obliteration of an old road and/or stream crossings would be a small residential road. Removing roads would include work in the riparian corridor. For this conservation measure number 8 from section 1.2.9 would be used. Removing road crossings would incorporate removal of a culvert or small bridge (for description and conservation measures see above 1.2.1).

1.2.3 Riparian Enhancement

The purpose of riparian enhancement is to restore function and rehabilitate the riparian corridor. Riparian functions include, temperature control, input of allochthonous material into the stream, and input of LWD into the stream. Riparian enhancements would include fencing out livestock and planting native vegetation. Every project would incorporate the following conservation measures: (1) all woody species would be protected with rodent guards and treated with big game repellent if necessary; and (2) fencing, care, and maintenance would be applied as needed. All of the proposed 29 projects include some riparian enhancement component.

1.2.4 Reconnecting Off-Channel Habitat

The purpose of reconnecting off-channel habitat is to provide rearing habitat for juvenile salmonids where this habitat type is limited. Reconnecting off-channel habitat typically includes deepening and widening old channels prior to reconnecting them. Each reconnection project would incorporate the following conservation measures: (1) all excavated material would be trucked out of the geomorphic flood plain; (2) if temporary stockpiling within the floodplain would be necessary it would occur outside of wetlands; (3) vegetation that must be removed for the excavation of the side channels will be salvaged and reused to the maximum extent possible;

and (4) measures number 1, 3, 5, 7, 8 listed in section 1.2.9. Presently, FF has planned to reconnect a maximum of 20 side channels for the next five years.

1.2.5 Nutrient Enhancement

The purpose of nutrient enhancement is to raise the nutrient levels in streams to historic levels. The supplemental nutrients enhance the food base for many elements of the food web, including algae and macroinvertebrates. Macroinvertebrates who are part of the food web that benefits from the nutrient supplementation are food for salmonids. Salmon carcasses from approved non-stream sources, generally hatcheries, would be distributed in the stream. Every project would incorporate the following conservation measures: (1) carcass deployers will avoid entering stream channels; (2) desired carcass numbers would be calculated with help of Washington Department of Fish and Wildlife (WDFW); and (3) deployment would be pulsed. Fish First plans annual nutrient enhancement activities if carcasses are available and streams show nutrient deficiencies.

1.2.6 Placement of Large Woody Debris

The purpose of placing Large Woody Debris (LWD) is to increase in-stream cover, and holding areas. Placement of LWD would occur according only to the specifications provided in Appendix G of the application (FF, 2003). Also, every project would incorporate all conservation measures listed below under section 1.2.9. The maximum duration for the installation of LWD would be four hours per piece. Presently, FF has planned to place a maximum of 800 pieces of LWD for the next five years.

1.2.7 Supplementing Spawning Gravel

The purpose of placing spawning gravel is to provide immediate habitat benefit where natural gravel recruitment is expected to be slow. Generally spawning gravel is placed upstream of cross vanes. Also, spawning gravel is proposed to be added in upwelling areas to enhance chum spawning habitat. Every project would incorporate the following conservation measures: (1) spawning gravel is proposed to be sized appropriately for target salmonids; and (2) each project would incorporate conservation measures 1, 2, 3, 7, and 8 listed in section 1.2.9, below. Presently, FF has planned to place spawning gravel above most of its cross vanes and on 800 feet of recreated chum spawning beds.

1.2.8 Creating In-Stream Habitat

The purpose of providing in-stream habitat is to immediately increase channel diversity and complexity. Fish First proposes to place boulder clusters/compression rock, J-hook vanes, and cross vanes to enhance in-stream habitat for salmonids. These structures would be built from either wood or rock. The placement of in-stream habitat structures would occur according to the detailed specifications provided in Appendix G of the application (FF, 2003). The duration of

in-stream work for each in-stream structure would be a maximum of five hours for J-hook vanes and eight hours for cross vanes. Fish First expects to construct a maximum of six projects with an in-stream component a year. Typical past projects have around 35 in-stream components, 25 LWD structures and 10 rock structures including J-hook vanes, cross vanes, and compression rock. Under the proposed action, FF would install a maximum of 60 rock structures a year. (Multiple rocks in a rock drop structure are counted as one structure.)

Every project would incorporate the following conservation measures: (1) All in-stream structures will be sited and constructed only by FF's hydrologist¹ and fish biologists; (2) where appropriate, material excavated from the streambed for footer rocks will be incorporated into adjacent project components; (3) if excavated material is not appropriate for inclusion into another adjacent structure, it will be removed and disposed of outside of the geomorphic floodplain; (3) finally, each project will incorporate all the conservation measures listed below in section 1.2.9.

1.2.9 Additional Conservation Measures

In addition to the specific measures described above, FF will ensure that the following measures are implemented for each project:

1. If any adult listed fish are spawning in or near a project area, the fish will not be disturbed and no construction activities will take place. The project will be modified or delayed to avoid disturbing spawners.
2. Electrofishing is not done in the vicinity of redds or spawning adults.
3. Impact from in water work will be minimized by working in the summer low flow periods listed in Table 1, below. Dates may be different for an individual project if stream conditions (run timing, flow, and temperature) warrant it. Data to support an extension of the general work window will be provided by the applicant to NOAA fisheries prior to in-stream work.

Table 1: Summer work windows

Location	Work Window
Lewis River: Mouth to East Fork Lewis River	July 15 - October 31
East Fork Lewis River: Mouth to Sunset Falls	July 15 - September 30
Copper Creek	July 15 - October 31
East Fork Lewis River Above Sunset Falls	July 15 - October 31

¹ Richard Dyrland

North Fork Lewis River: Confluence with East Fork Lewis River to Merwin Dam	August 1 - August 31
Cedar Creek	July 15 - September 30
North Fork Lewis River: Mervin Dam to Lower Falls	July 1 - July 31

4. Removal of old culverts and bridges, and placement of fish passage structures, LWD, and in-stream habitat structures can be performed in the dry or wet depending on scope of work, site, and hydrologic conditions. For channel spanning structures and cross vanes, work may be performed in the wet if average water depth is less than six inches and maximum velocity is less than one-foot per second and substrate is coarse. If any one of the three conditions is not met, work will be performed in the dry. Under these conditions the impact from the construction related sedimentation is considered to be less than the impact that would result from diverting the stream. If average channel water depth is more than six inches, or velocity is more than one foot per second, or substrate is fine, work is proposed to be performed in the dry, after diverting the stream around the work site.
5. The following measures will be taken to further minimize the risk of take to salmonids when working in the wet channel: First set upstream block net, then make at least three downstream passes through the work area to move rearing juveniles downstream; no downstream net will be set as it is expected that juveniles that were not hazed out successfully will move temporarily downstream to avoid project generated turbidity.
6. The following measures will be taken to further minimize the risk of take to salmonids when working with a bypass to temporarily isolate the work area from stream flow:

If fish are present, they will be removed from work area prior to start of construction by (a) placing an upstream block net; (b) making at least three downstream passes through the work area to herd juveniles downstream; and (c) setting a downstream block net.

If the worksite contains ample hiding spaces for juvenile salmonids (for example the presence of overhanging banks, or loose gravel), electroshocking will be used after herding fish downstream to capture and release juvenile salmonids trapped in the work area. For electroshocking the applicant will follow the NOAA Fisheries Electroshocking guidelines, found at:
<http://www.nwr.noaa.gov/1salmon/salmesa/4ddocs/final4d/electro2000.pdf>

A sandbag revetment or similar device will be installed at the bypass inlet to divert entire flow through the bypass. A second sandbag revetment or similar device will be installed upstream of the bypass outlet to prevent backwater from entering the work area. While the site is slowly being de-watered and after water has been diverted, juvenile fish not removed by the seining and successive electroshocking, will be captured with dip nets and transferred to free-flowing water downstream of the project site.

When bypass pumps are used for site de-watering, pump intakes will be screened according to NOAA Fisheries screening criteria, which may be found at: <http://www.nwr.noaa.gov/1hydrop/pumpcrit1.htm>. Temporary bypasses will be sized large enough to accommodate the predicted peak flow rate during construction. Dissipation of flow at the outfall of the bypass system (e.g., splash protection, sediment traps) will be installed to diffuse the erosive energy of the flow.

The action includes the benefit of adaptive management to help define criteria for selecting between the four work methods in future projects: (1) in the wet channel with block nets; (2) in the wet channel without block nets; (3) in the dry-channel after seining; and (4) in the dry-channel after seining and electroshocking. An annual report (required in the permit) will provide FF and NOAA Fisheries with the data to improve the decision points for which method to use.

7. The operation of heavy equipment in active streams will be kept to a minimum. When this cannot be practically avoided, the equipment used shall be in good repair, with no oil leaks, and steam cleaned prior to commencement of in-stream work. Fueling and other routine and periodic maintenance shall be conducted out of the stream at a site specifically designated for such activities. This site shall be appropriately protected and operator supplied pollution control materials available onsite to ensure oil spills are contained and cannot soak into the ground or make their way to a water source.
8. Sedimentation and erosion controls (i.e. hay bales, silt fences, jute mat placement, etc.) will be implemented on project sites and staging areas to minimize the release of fines into the aquatic environment.

NOAA Fisheries will include the foregoing conservation measures as well as the general terms and conditions (Appendix A) in the proposed permit.

1.3 Description of the Action Area

The area for which FF proposes projects is limited to private properties on the Lewis River System. The present list of 29 proposed project includes 22 projects on the East Fork Lewis River, and seven on the Lower North Fork Lewis River (of which, five are on Cedar Creek).

Cedar Creek is a major tributary to the Lower North Fork Lewis River that has a high concentration of salmonid spawning.

The action area for each project includes:

- The stream channel where habitat improvements will be installed, or fish passage will be restored.
- Downstream areas that are impacted by sedimentation: 100 feet for streams with 10 cubic feet per second (cfs) discharge or less, 200 feet for streams with 10 to 100 cfs discharge, and 300 feet for streams with over 100 cfs discharge.
- The riparian area affected by equipment access.
- The riparian area where native vegetation will be planted.

2.0 ENDANGERED SPECIES ACT BIOLOGICAL OPINION

2.1 Evaluating Proposed Actions

The standards for determining jeopardy as set forth in section 7(a)(2) of the ESA are defined by 50 CFR Part 402 (the consultation regulations). NOAA Fisheries must determine whether the action is likely to jeopardize the listed species or adversely modify or destroy their designated critical habitat. No critical habitat is presently designated for species addressed in this Opinion, therefore the critical habitat analysis is not addressed. The jeopardy analysis involves the initial steps of (1) defining the biological requirements of the listed species, and (2) evaluating the relevance of the environmental baseline to the species' current status.

Subsequently, NOAA Fisheries evaluates whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for recovery. In making this determination, NOAA Fisheries must consider the estimated level of injury and mortality attributed to: (1) collective effects of the proposed or continuing action; (2) the environmental baseline; and (3) any cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed salmon's life stages that occur beyond the action area. If NOAA Fisheries finds that the action is likely to result in jeopardy, NOAA Fisheries must identify reasonable and prudent alternatives for the action.

For the proposed action, NOAA Fisheries' jeopardy analysis considers the direct or indirect effects of the action on, and the extent to which the proposed action impairs the function of habitat elements essential for spawning, rearing, feeding, sheltering, or migration of, certain Evolutionarily Significant Units (ESUs) of listed fish. The ESUs are considered a genetically identifiable component of a species that may be protected under the ESA. The NOAA Fisheries analysis considers how these effects influence the likelihood of survival and recovery of LCR steelhead, LCR spring chinook salmon, and CR chum salmon, when compared to the existing environmental baseline.

2.1.1 Biological Requirements

The first step in the methods NOAA Fisheries uses for conducting its ESA section 7(a)(2) analysis is to define the species' biological requirements. Biological requirements are those conditions necessary for the listed species to survive and recover to naturally reproducing population levels, at which time protection under the ESA would be unnecessary. Species (or ESUs) not requiring ESA protection have the following attributes: population sizes large enough to maintain genetic diversity and heterogeneity; the ability to adapt to and survive environmental variation; and the ability to be self-sustaining in the natural environment.

For this consultation, the relevant biological requirements are functioning riparian conditions, flood plain connectivity, undisturbed passage conditions (migratory access to and from potential spawning and rearing areas), improved sediment conditions (reduced input of fines), improved channel conditions (depending on location more LWD, abundant and suitable spawning gravel, enhanced pool habitat), sufficient water quality (reduced summer temperatures), and water quantity (increased summer flows). These biological requirements were identified as limiting salmonid production for the Lower Lewis River and East Fork Lewis River in the Washington State Limiting Factors Analysis for Water Resource Inventory Area (WRIA) 27 (Wade, 2000).

2.1.2 Environmental Baseline

The environmental baseline represents the current set of conditions to which the effects of the proposed action are then added. The environmental baseline is defined as “the past and present impacts of all Federal, state, and private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or informal section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation process” (50 CFR 402.02). The term “action area” is defined as “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.”

2.1.2.1 Factors Affecting the Species Environment within the Action Area

Salmonid habitat in the North Fork Lewis River has been limited by the construction of Merwin Dam in 1931. Approximately 80% of the historic anadromous habitat is now inaccessible. Other than trap and haul programs, passage past the dam or dam removal is not likely for the near future. Some culverts block salmonid access to tributaries to the Lower North Fork Lewis River. Almost the entire lower floodplain of the Lewis River has been disconnected from its floodplain by diking. Cedar Creek and Chelatchie Creek have a limited amount of wetlands and areas that offer opportunity for enhancement. Large woody debris concentrations are low and riparian conditions could be improved (Wade, 2000).

Salmonid habitat in the Cedar Creek watershed has been adversely affected by the following anthropogenic activities: Extensive logging, the use of splash dams, direct removal of LWD from the channel, poor agricultural practices including cattle grazing up to and into the stream

channel. As a result, riparian conditions are poor in many areas, summer stream temperatures are high, the abundance and recruitment of LWD is low, fine sediment input is high and thus the gravel is moderately embedded, and the pool frequency is low. Also, the channel has down-cut and is widened and flattened (increased width to depth ratio). Due to the down-cutting, side channels that used to provide summer rearing habitat are now isolated in the summer (pers. com. Russ Lawrence, 2001). Salmonid habitat in the East Fork Lewis River suffers passage problems in some tributaries. Riparian conditions are poor and in-stream LWD concentrations are low (Wade, 2000).

In summary, NOAA Fisheries concludes that not all of the biological requirements of the species are being met under current conditions within the action area. The baseline is degraded from the effects of Merwin Dam and other human activities, including agriculture, forestry, and residential and commercial development.

2.1.3 Status of the Species

NOAA Fisheries also considers the current status of the listed species, taking into account population size, trends, distribution and genetic diversity. To assess the current status of the listed species, NOAA Fisheries starts with the determinations made in its original decision to list the species for protection under the ESA. Additionally, the assessment will consider any new information or data that are relevant to the determination. Table 2, contains specific information related to the listing status and life histories for listed salmonids addressed in this Opinion.

Table 2. Status of listed species addressed in this Opinion and citations for biological information.

Fish Species/ ESU	Listing Status	Citations for Biological Information
Lower Columbia River Chinook Salmon	Final - March 24, 1999; 64 FR 14308	Myers <i>et al.</i> 1998
Lower Columbia River Steelhead	Final - March 19, 1998; 63 FR 13347	Busby <i>et al.</i> 1996
Columbia River Chum Salmon	Final - March 25, 1999; 64 FR 14507	Johnson <i>et al.</i> 1997

2.1.3.1 Lower Columbia River Steelhead

Lower Columbia River steelhead were listed as threatened under the ESA on March 19, 1998 (63 FR 13347). In Washington, the LCR steelhead ESU includes winter and summer steelhead

in tributaries to the Columbia River between the Cowlitz River and Wind River, inclusive (Busby *et al.* 1996).

The LCR steelhead is likely to become endangered in the foreseeable future based on information reported in Busby *et al.* (1996). Nineteen stocks of steelhead within the LCR ESU were identified as at risk of extinction or of special concern (Nehlsen *et al.* 1991). Recent and historical information related to abundance of steelhead is summarized in Busby *et al.* (1996).

There are several factors for decline of LCR steelhead including habitat degradation, overharvest, predation, hydroelectric dams, hatchery introgression, and the eruption of Mount Saint Helens. Habitat degradation or elimination is mainly due to urbanization, forestry, water diversions, and mining. There is strong concern about the pervasive influence of hatchery stocks within the ESU. There is no tribal or direct commercial fishery on steelhead although incidental catch of wild steelhead may occur in lower Columbia River fall gillnet fishery. (Busby *et al.*, 1996 and SASSI, 1993)

The Lewis River System has runs of wild summer and winter steelhead. Wild summer and winter steelhead in the Lewis River watershed are considered by the WDFW to be distinct stocks based on the geographical isolation of the spawning population. Construction of Merwin Dam in 1962 blocked access to approximately 80% of the historic spawning and rearing habitat on the North Fork Lewis River. Presently most of the natural steelhead production in the North Fork Lewis occurs in Cedar Creek. North Fork Lewis stocks are identified by WDFW as depressed, due to the loss of access to historic spawning and rearing habitat upstream of Mervin Dam and the limited/degraded habitat in Cedar Creek. Stocks in the East Fork Lewis River are thought to be depressed as well. Adult winter steelhead generally return November through April and spawn March to early June. Adult summer steelhead generally return May through November and spawn March through May. (SASSI, 1993) Smoltification occurs for most LCR steelhead at age two. (Busby *et al.* 1996)

The WDFW, Southwest Region, conducts wild winter steelhead redd surveys on the East Fork Lewis River and Cedar Creek, a tributary to the North Fork Lewis River. They operate an adult trap on Cedar Creek. Snorkel surveys to count adult summer steelhead are conducted on the mainstem East Fork Lewis River. Also, WDFW operates a rotary screw trap on Cedar creek to estimate smolt production. Table 3 summarizes spawning escapement and smolt production estimates for Cedar Creek.

Table 3. Steelhead spawning escapement and smolt production estimates for Cedar Creek.

	Location	1998	1999	2000	2001	2002
Wild winter steelhead escapement from redd surveys	Cedar Creek	38	52	NA	NA	NA
Wild winter steelhead index escapement from adult trap ²	Cedar Creek	11	52	73	41	
Smolt production, steelhead, estimates from rotary screw trap (95% C.I.)	Cedar Creek	6,648 (5,976 - 7,320)	2,268 (1,952 - 2,584)	3,000 (2,670 - 3,330)	3,565 (2,754 - 4,385)	2,690 (2,227 - 3,152)

Bob Bilby reports summer rearing densities of .5 juvenile steelhead per square meter in managed forest lands in southwest Washington State (pers. com. 2003).

2.1.3.2 Lower Columbia River Chinook Salmon

Lower Columbia River chinook salmon were listed as a threatened species under the ESA on March 24, 1999 (64 FR 14309). In Washington, the LCR chinook ESU includes all naturally spawned chinook populations from the mouth of the Columbia River to the Cascade Crest.

Natural production of LCR chinook has been substantially reduced over the last century and long and short-term trends in abundance of individual populations are negative. There have been at least six documented extirpations of populations in this ESU, and other extirpations may have been masked by naturally spawning hatchery fish. (Myers *et al.*, 1998)

Factors for decline of the LCR chinook have been attributed to poor freshwater habitat throughout the ESU (Myers *et al.*, 1998). Habitat degradation is primarily related to forest practices, urbanization in the Portland and Vancouver areas, hydroelectric dams, and agricultural practices. The LCR chinook also have been negatively influenced by genetic introgression from artificial propagation programs (March 9, 1998, 63 FR 11495). Current evidence indicates a pervasive influence of hatchery fish on natural populations throughout this ESU where over 200 million fish from outside the ESU have been released since 1930 (Myers *et al.*, 1998).

There are two distinct runs of Lewis River chinook: spring chinook and fall chinook. Lewis River spring chinook are a mixed stock of hatchery and wild fish. Construction of Merwin Dam blocked passage to the majority of the historic spawning and rearing habitat. Presently, most of

²An index count denotes that an escapement was estimated for a portion of the stream.

the remaining natural spawning takes place immediately below Merwin Dam and in Cedar Creek. Meyers *et al.* (1998) reports a long-term abundance trend of minus 1.9% for Lewis River spring chinook. Freshwater migration begins in March. Spawning extends from late August to early October (SASSI, 1993; Meyers *et al.*, 1998). Smolt out-migration from Cedar Creek occurs March through May. Generally, chinook are out of the Lewis River by July 15 (pers.com. John Weinheimer, WDFW, 2003). Out-migration occurs as yearlings, 88%, and sub-yearlings, 12% (Meyers *et al.*, 1998). John Weinheimer, WDFW, reports from recent observations that most spring chinook emigrate as subyearlings.

Lewis River fall chinook spawn within a four mile reach downstream of Merwin Dam. Meyers *et al.* (1998) reports a long-term egg-to-fry survival trend of 0.1% for fall chinook. Freshwater migration begins in mid-August. Spawning occurs between October and January (Meyers *et al.*, 1998 and SASSI, 1993). The majority of fall chinook emigrate as subyearlings, 97% (Meyers *et al.*, 1998). Generally, fall chinook are out of the Lewis River by July 15 (pers.com. John Weinheimer, WDFW, 2003)

2.1.3.3 Columbia River Chum Salmon

Columbia River chum salmon were listed as threatened under the ESA on March 25, 1999 (64 FR 14507). Historically, chum salmon were abundant in lower portions of the Columbia River and supported annual harvests of hundreds of thousands of fish. Presently, relative abundance of chum salmon is likely less than one percent of historical levels with most spawning occurring in three tributaries to the Columbia River (Hardy Creek, Hamilton Creek, and Grays River) and in the mainstem Columbia River near Bonneville Dam (Ives Island). Spawner surveys of chum salmon in three streams indicated that a few thousand to 10,000 chum salmon spawn each year in the Columbia River Basin (Johnson *et al.* 1997).

The factors for decline in naturally reproducing chum salmon populations are primarily attributed to habitat degradation, water diversions, harvest, dams, loss of estuarine habitats, and artificial propagation. Presently, there are no recreational or commercial fisheries for chum salmon in the Columbia River although some fish are incidentally taken in the gill-net fisheries for coho and chinook salmon (SASSI 1993, WDFW 2003).

Columbia River chum enter the Columbia River between October and December. Spawning occurs between November and January. Fry hatch depending on water temperature one to four and one-half months afterwards. After hatching fry immediately move downstream into the estuary (Johnson *et al.* 1997). Chum have been documented in the Lewis River. Spawning is known to occur in upwelling areas in the lower six miles of the East Fork Lewis River (WDF 1973).

2.2 Effects of the Proposed Action

The ESA implementing regulations define “effects of the action” as “the direct and indirect effects of an action on the species...together with the effects of other activities that are

interrelated or interdependent with that action, that will be added to the environmental baseline.” “Indirect effects” are defined as those that are caused by the proposed action at a later time, but still are reasonably certain to occur (50 CFR 402.02). The proposed enhancement projects are likely to adversely affect LCR chinook, CR chum, and LCR steelhead on a short-term basis, as result of construction impacts and handling. They are also likely to adversely affect LCR chinook, LCR steelhead, and CR chum indirectly, when the in-stream structures fail. Overall, the proposed habitat improvements are expected to result in a mid-to-long-term beneficial effect.

2.2.1 Direct Effects

Direct effects are the immediate effects of the project on the species or its habitat. Direct effects result from the agency action and include the effects of interrelated actions and interdependent actions. Future Federal actions that are not a direct effect of the action under consideration (and not included in the environmental baseline or treated as indirect effects) are not evaluated. (USFWS and NMFS 1998)

Beneficial Effects

The intent of all proposed FF actions is to improve the functional condition of salmonid habitat. The best tool presently available to plan habitat improvements in the Lewis River basin, below Forest Service ownership, is the Limiting Factors Analysis (Wade, 2000). The assumption underlying all proposed FF projects is that addressing the limiting factors identified in Wade 2000 will improve salmonid habitat and ultimately result in better salmonid survival.

This assumption is hard to verify with data. Long-term monitoring more extensive than the level routinely done by the WDFW would be needed to measure an effect of the habitat improvement projects implemented by FF (Roni *et al.* 2002). No such extensive monitoring is in place or proposed. However, FF has observed immediate use of their in-stream structures by rearing and spawning salmon (pers. comm. R. Dyrland, 2003).

For enhancement projects to improve habitat quality they not only need to address limiting factors but also must be designed and executed properly. Fish First has a record of quality project planning and implementation. The team designer, fish biologist, and contractors specified in the application (FF, 2003) has been working for six years (first enhancement project in 1997) on projects in the Lewis River basin. Their past in-stream projects survived high water events without damage. Thus, no habitat loss due to pre-design life failure is expected to occur.

The long-term habitat benefits expected from the projects are:

- Fish Passage Restoration -- Improved salmonid access to habitats from which they have been excluded by man-made structures.
- Obliteration of Old Roads and Road Crossings -- Improved riparian corridors.

- Riparian Enhancement -- Improved riparian functions including temperature control, input of allochthonous material, and input of LWD into the stream.
- Reconnecting Off-Channel Habitat -- Increased availability of limited rearing habitat for juvenile salmonids.
- Nutrient Enhancement -- Raising the nutrient levels in the streams to historic levels to support the food web which provides food for salmonids.
- Placement of LWD -- Increased in-stream cover and holding areas.
- Supplementing Spawning Gravel -- Immediate increase in available spawning areas.
- Creating in-Stream Habitat -- Immediate increase in channel diversity and complexity.

While enhancement projects will create beneficial long-term results for fish, they usually involve short-term, adverse, construction effects. These effects include exposure to sedimentation, seining fish downstream, temporary displacement, electrofishing, and small losses of riparian functions. Sedimentation will result from in-stream construction performed with or without a bypass. Exposure to herding fish downstream with seines and displacement is an expected result of isolating a work area. Electrofishing would be used when isolating and dewatering a work area. Temporary loss of riparian function would occur as a result of small scale clearing of vegetation to access the stream.

Sedimentation

To evaluate the effects of increased suspended solids (SS) on salmonids one needs to consider many parameters including the level of increase in SS, the duration, timing, and frequency (Bash *et al.* 2001). Depending on the level of these parameters, sedimentation can cause lethal, sublethal, and behavioral effects in juvenile and adult salmonids (Newcombe and Jensen, 1996). Behavioral effects in response to elevated SS levels include avoidance, sub-lethal effects include reduction in feeding rates, stress, gill flaring, and coughing (Spence *et al.* 1996).

The summer construction timing, proscribed to limit exposure to the fewest salmonid life stages possible, potentially increases the adverse effect of increased sedimentation. Sedimentation from natural causes such as rainstorms and slope failure is mostly correlated with winter high flow events. Increased sedimentation in the summer is thought to effect salmonids more severely than in winter because fish secrete less protective mucous during that time of year (Bash *et al.* 2001).

NOAA Fisheries conducted a generalized quantitative assessment to estimate take associated with sedimentation resulting from instream construction. For this generalized assessment, NOAA Fisheries used research published in Newcombe and Jensen, 1996. Newcombe and Jensen, 1996, categorized the fish response to increases in suspended sediment (different categories of lethal and sublethal levels, see table 4 below) and developed linear relationships for juvenile and adult salmonids linking the duration and severity of exposure to a response.

Table 4: Scale of the severity of ill effects associated with excess suspended sediment

SEV	Description of effect
0	No behavioral effect
1	Alarm reaction
2	Abandonment of cover
3	Avoidance response
4	Short-term reduction in feeding rates; Short-term reduction in feeding success, less than two hours.
5	Minor physiological stress; increase in rate of coughing; increased respiration rate
6	Moderate physiological stress
7	moderate habitat degradation; impaired homing
8	Indicators of major physiological stress
9	reduced growth rate, delayed hatching
levels 10 to 14	Lethal effects

The question to address now is which severity level constitutes take. Take is defined by the ESA to mean “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect” (section 3(19)). NOAA Fisheries’ regulations further define harm as “an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modifications or degradations where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering” (64 FR 60727). These final regulations on harm provide examples of actions that may constitute take. Example nine applies: Conducting ..., earth-moving or other operations which result in substantially increased sediment input into streams. If the actions under consideration result in a substantial increase in sediment input is difficult to decide. Thus, we approach the question from the angle of the effect on salmonids.

A severity level of four stands for a short-term (less than two hours) reduction in feeding rate. The authors explain that “they reflect less a change in fish behavior than reduced availability of food and reduced visual hunting range.” This is a measurable adverse effect that does not amount to the level of harm. Reducing feeding rate for less than two hours does not injure a juvenile by significantly impairing feeding or rearing. The same cannot be argued as easily for a

severity level of five. At a severity level of five, moderate physiological stress, increase in rate of coughing, and increased respiration rate are added to the reduction in feeding. A moderate physiological stress could be interpreted as injuring a juvenile by significantly impairing rearing. Conservatively, increased sedimentation that results in a response of severity level five is considered harm and non-lethal take. Harm is considered likely at severity levels of five to nine (see table 4). At a severity level of 10 to 14, Newcombe and Jensen, 1996, report direct mortality, lethal take.

The response relation (Appendix C) indicates that for seven hours of instream work, non-lethal take is expected to occur in the area downstream of the project where suspended solids are greater than 20 mg SS/l above background. We do not have data to determine the extent of that area. However, we do know that FF's projects must meet Washington State Water Quality Standards which include allowable downstream limits for increased turbidity. We can use these limits to estimate the downstream area in which permissible take would occur.

Washington State Water Quality Standards (WQ standards) allow different mixing zones depending on the flow at the time of construction³. At the downstream end of the mixing zone, turbidity shall not exceed 5 NTU over background when the background turbidity is less than 50 NTU. As measured by the Washington State Department of Ecology (DOE) at the East Fork Lewis River at Dollar Corner, during the summer construction window, June 1 through October 31, the turbidity has not exceed 14 NTU (49 mg SS/l) between 1978 and 2002 (Appendix D).

To utilize the turbidity measurements taken for WQ standards compliance and relate them to the exposure response tables from Newcombe and Jensen 1996, one needs to convert NTUs into SS. To derive a conversion factor we used DOE's Water Quality data for the East Fork Lewis River at Dollar Corner from 1993 to 2002. In October, 1993 DOE switched to the ratio turbidity meter method to measure turbidity so data prior to this were not used to derive the conversion equation. Assuming that data from this station are representative for the entire Lewis River system is a generalization. To account for locations where, the SS to NTU relationship differs from the empirical equation for Dollar Corner, NOAA Fisheries will add a safety margin. The NTU and SS data are available on DOE's web page at http://www.ecy.wa.gov/programs/eap/fw_riv/rv_main.html. Regression analysis was used to determine the empirical relationship between SS and turbidity and to develop an equation to predict SS from turbidity.

$$\text{Log}_{10} \text{SS} = .025 + .53 * \text{Log}_{10} \text{Turbidity} + .36 * (\text{Log}_{10} \text{Turbidity})^2$$

(see Graph 1 Appendix A)

³For streams up to 10 cfs flow at the time of construction, the point of compliance shall be one hundred feet downstream of the activity causing the turbidity. For waters between 10 cfs and 100 cfs flow at the time of construction, the point of compliance shall be two hundred feet downstream. (State Water Quality Standards - Surface Waters 173-201A-110)

The r^2 was 0.72 and standard error of the estimate was 0.21.

An increase of five NTU over mean background equals 8.3 mg SS/l. The exposure response relationship from Newcombe and Jensen, 1996 (Appendix C) shows that for up to seven hours⁴ exposure the predicted salmonid response for 8.3 mg SS/l would be at a severity level four (short-term reduction in feeding rate) which is considered an adverse effect that does not amount to the level of harm. Harm for exposure up to eight hours would occur at an increase in concentration of above 20 mg SS/l over background and approximately 11 NTU, respectively. NOAA Fisheries estimates that, using the entire mixing zone would delineate the area where severity effects of five to nine and concentrations between 20 mg SS/l and 8103 mg SS/l above background are likely to occur, including a safety margin. Past project experience suggests that none of the proposed eight project categories would result in lethal levels of take, increase in concentration of above 8,103 mg SS/l over background.

In summary, harm in the form of non-lethal take is expected at severity levels five to nine and corresponding increase in sedimentation of 20 mg SS/l (11 NTU) to 8103 mg SS/l for less than eight hour of instream work. Lethal take is likely for severity levels 10 to 14 and corresponding increase in sedimentation of above 8,103 mg SS/l for less than eight hours of instream work. Turbidity measurements and take quantification (see annual report in permit) will show if these take estimates are appropriate. If not, they will be amended after review of the first year data. These results are summarized in Table 5.

Table 5: Take related to increased sedimentation

Exposure time/ Instream work time	Nonlethal Take	DOE WQ standards	Downstream area in which take is expected
up to 8 hrs	20 mg SS/l 11 NTU to 8103 mg SS/l	5 NTU at 100, 200, or 300 feet	100 feet for 10 cfs or less 200 feet for 10 cfs to 100 cfs 300 feet for above 100 cfs

Seining Fish Downstream

Seining fish downstream to eliminate them from the work area can adversely affect salmonids. While attempting to herd fish downstream, they can contact the net. Though, the likelihood of death or injury as a result of contact is considered to be negligible.

⁴Fish First maximum instream work time is eight hours. Due to the linear relation underlaying the severity to exposure duration and exposure concentration, it is not far off using the same severity levels for eight ours of exposure as the levels for seven hours (listed in Appendix C).

Temporary Displacement

Every isolation of the work area results in temporary displacement. Depending on the location and environmental conditions displacement in the summer can be stressful for juvenile salmonids. Stress can be introduced by having to find suitable, unoccupied holding and feeding locations and avoiding predation. One can assume that a variable but small percentage of juveniles will suffer harm as a result of displacement. No data could be found to estimate the small percentage of displaced juveniles that may be harmed.

Fish Capture and Handling

Capturing and handling fish causes them stress—though they typically recover fairly rapidly from the process. Therefore, the overall effects of the procedure are generally short-lived. The primary contributing factors to stress and death from handling are differences in water temperatures (between the river and wherever the fish are held), dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma. Stress on salmonids increases rapidly from handling if the water temperature exceeds 18°C or dissolved oxygen is below saturation. Fish that are transferred to holding tanks can experience trauma if care is not taken in the transfer process.

Electrofishing

Electrofishing is a process by which an electrical current is passed through water containing fish in order to stun them—thus making them easier to capture. It can cause a suite of effects ranging from simple harassment to actually killing the fish (adults and juveniles) in an area where it is occurring. The amount of unintentional mortality attributable to electrofishing may vary widely depending on the equipment used, the settings on the equipment, and the expertise of the technician. Electrofishing can have severe effects on adult salmonids. Spinal injuries in adult salmonids from forced muscle contraction have been documented. Sharber and Carothers (1988) reported that electrofishing killed 50% of the adult rainbow trout in their study. The long-term effects electrofishing has on both juvenile and adult salmonids are not well understood, but long experience with electrofishing indicates that most impacts occur at the time of sampling and are of relatively short duration.

The effects of electrofishing on LCR steelhead and chinook would be limited to the direct and indirect effects of exposure to an electric field, capture by netting, holding captured fish in aerated tanks, and the effects of handling associated with transferring the fish back to the river (see above for more detail on capturing and handling effects). Most of the studies on the effects of electrofishing on fish have been conducted on adult fish greater than 300 mm in length (Dalbey *et al.* 1996). The relatively few studies that have been conducted on juvenile salmonids indicate that spinal injury rates are substantially lower than they are for large fish. Smaller fish intercept a smaller head-to-tail potential than larger fish (Sharber and Carothers 1988) and may therefore be subject to lower injury rates (e.g., Hollender and Carline 1994, Dalbey *et al.* 1996, Thompson *et al.* 1997). McMichael *et al.* (1998) found a 5.1% injury rate for juvenile MCR

steelhead captured by electrofishing in the Yakima River subbasin. The incidence and severity of electrofishing damage is partly related to the type of equipment used and the waveform produced (Sharber and Carothers 1988, McMichael 1993, Dalbey *et al.* 1996, Dwyer and White 1997). Continuous direct current (DC) or low-frequency (greater than or equal to 30 Hz) pulsed DC have been recommended for electrofishing (Fredenberg 1992, Snyder 1992, Dalbey *et al.* 1996) because lower spinal injury rates, particularly in salmonids, occur with these waveforms (Fredenberg 1992, McMichael 1993, Sharber *et al.* 1994, Dalbey *et al.* 1996). Only a few recent studies have examined the long-term effects of electrofishing on salmonid survival and growth (Ainslie *et al.* 1998, Dalbey *et al.* 1996). These studies indicate that although some of the fish suffer spinal injury, few die as a result. However, severely injured fish grow at slower rates and sometimes they show no growth at all (Dalbey *et al.* 1996).

NOAA Fisheries' electrofishing guidelines (NMFS 2000c) will be followed in all projects employing electrofishing equipment. The guidelines require that field crews be trained in observing animals for signs of stress and shown how to adjust electrofishing equipment to minimize that stress. Electrofishing will be used only when other methods to eliminate salmonids for work areas are not feasible. Electrofishing is not done in the vicinity of redds or spawning adults. All electrofishing equipment operators are trained by qualified personnel to be familiar with equipment handling, settings, maintenance, and safety. Only DC units will be used, and the equipment will be regularly maintained to ensure proper operating condition. Voltage, pulse width, and rate will be kept at minimal levels and water conductivity will be tested at the start of every electrofishing session so those minimal levels can be determined. When such low settings are used, shocked fish normally revive instantaneously. Fish requiring revivification will receive immediate, adequate care.

The preceding discussion focused on the effects of using a backpack unit for electrofishing and the ways those effects will be mitigated. It should be noted, however, that in larger streams and rivers electrofishing units are sometimes mounted on boats or rafts. These units often use more current than backpack electrofishing equipment because they need to cover larger (and deeper) areas and, as a result, can have a greater impact on fish. In addition, the environmental conditions in larger, more turbid streams can limit researchers' ability to minimize impacts on fish. That is, in areas of lower visibility it can be difficult for researchers to detect the presence of adults and thereby take steps to avoid them. Because of its greater potential to harm fish, and because NOAA Fisheries has not published appropriate guidelines, boat electrofishing has not been given a general authorization under NOAA Fisheries' recent ESA section 4(d) rules. However, it is expected that guidelines for safe boat electrofishing will be in place in the near future. And in any case, all researchers intending to use boat electrofishing will use all means at their disposal to ensure that a minimum number of fish are harmed (these means will include a number of long-established protocols that will eventually be incorporated into NOAA Fisheries' guidelines).

Loss of Riparian Function

The projects will require riparian vegetation removal to allow project site access. Depending on the site conditions, some trees may have to be removed. A review of past projects shows that FF has accomplished their projects with a minimum of riparian disturbance. Considering that FF works with effective minimization measures, that FF will replant all cleared areas with native woody vegetation, and that FF incorporates riparian enhancement in most of their projects, the adverse impact from this project element appears negligible.

2.2.2 Activity Specific Effects

With the application FF submitted a list of 29 projects they are planning to construct within the next five years. These projects as well as past projects that were constructed under a section 7 permit were used to estimate project type effects and take. These take estimates are not expected to vary if FF should substitute different projects for projects presently on the list. New projects will have to fall within the eight categories of activities covered by the permit.

Fish Passage Restoration

FF proposes to remove four fish passage barriers (project 4 and 13) while dewatering a maximum of 100 feet of project area for each structure. Dewatering a stream section would include seining fish downstream, electrofishing, capturing and handling (For details see 1.2.9 Conservation Measure 7). To estimate take, it was assumed that it is likely that seining juveniles downstream will not succeed at many locations. All juveniles present were counted for the take estimate. The following formula was used:

$$T = N * D * W * FD$$

$$T = 4 * 33 \text{ m} * 3 \text{ m} * .5 \text{ —} 2$$

$$T = 198$$

$$TL = (N * D * W * FD)M$$

$$TL = (4 * 33 \text{ m} * 3 \text{ m} * .5 \text{ m}^{-2}) * 0.051$$

$$TL = 10.1$$

T: Harm of steelhead as a result of temporary displacement, or capture and handling.

TL: Lethal Take, unintentional death due to electrofishing.

N: Number of instream structures

D: To be dewatered area. In general, it is expected that 33 meters are the largest of to be dewatered length

W: Width of the be dewatered area estimated at 3 meters

FD: Fish density, assumed at .5 steelhead per square meter (pers. com. Bob Bilby, 2003)
M: Mortality estimated at 5.1% (McMichael *et al*, 1998)

ESU/Species	Life Stage	Take Activity	Overall Take	Unintentional Mortality
LCR Steelhead	Juvenile	D/C/H/R	198	10
LCR Steelhead	Adult	D/C/H/R	1	0
LCR Chinook	Juvenile	D/C/H/R	2	1

(D=Displacement, C=Capture, H=Handle, R=Release)

Unintentional mortalities are considered part of the overall take. Thus, for example, of 198 juvenile steelhead that are expected to be taken, only 10 are expected to die.

We do not have areal densities for adult steelhead available. Considering the low numbers of adult steelhead that are known for some tributaries (Table 3), we estimated that it would be likely that one adult steelhead would be harassed. John Weinheimer of WDFW reports that most spring chinook emigrate as subyearlings (pers. com., see above). Thus we expect very few summer rearing chinook. These assumption are the basis for all take estimates for adult LCR steelhead and juvenile LCR chinook.

Obliteration of Old Roads and Road Crossings

The effects of obliterating old roads would be similar to those described below under “Riparian Enhancement”. The effects of removing road crossings would be included in “Fish Passage Restoration”. Presently FF does not have any proposed projects under this category.

Riparian Enhancement

Riparian enhancement is part of most of the 29 proposed projects. Impacts from riparian enhancements are limited to sedimentation that may occur in spite of the erosion control measures and minimal loss of riparian function. Both impacts are considered negligible.

Reconnecting Off-Channel Habitat

Reconnection of off-channel habitat generally takes place in two phases. First, the off-channel habitat is restored. Elevation, substrate, vegetation and LWD are addressed. Second, the fully enhanced side channel is reconnected to the stream by removing the plug at the connection point. The last step is likely to introduce some sediment into the stream. Impacts to salmonids from reconnecting off-channel habitat is expected to be limited to the sedimentation impact.

Fish First proposes to reconnect a maximum of 20 side channels (projects 1, 6, 7, 8, 11, 24, and 26). All of these projects are located on streams with expected summer flows below 100 cfs, most of them with flows below 10 cfs. Dewatering is not proposed for any of the projects.

The expected effect of increased sedimentation is discussed above. To estimate the expected nonlethal take we calculated the number of fish in the downstream area effected by increased sedimentation.

$$T = N * D * W * FD$$

$$T = 20 * 66 \text{ m} * 3 \text{ m} * .5 \text{ —}2$$

$$T = 1980$$

T: Harm to juvenile steelhead as a result of temporary displacement, or sedimentation.

N: Number of side channels to be reconnected

D: Downstream extent of sedimentation resulting in harm

W: Width of the stream estimated at 3 meters

FD: Fish density, assumed at .5 steelhead per square meter (pers. com. Bob Bilby, 2003)

ESU/Species	Life Stage	Take Activity	Overall Take	Unintentional Mortality
LCR Steelhead	Juvenile	D/S	1980	0
LCR Steelhead	Adult	D/S	10	0
LCR Chinook	Juvenile	D/S	20	0

(D=Displacement, S=Sedimentation)

Nutrient Enhancement

Impacts from annual carcass deployment are considered to be negligible.

Placement of Large Woody Debris

Placement of LWD is described in section 1.2.6. It typically includes driving equipment on the bank and in the stream. It may include excavating the stream bank to anchor LWD. The only adverse effect expected from this activity is a short-term increase in suspended sediment. Presently FF proposes to install a maximum of 800 pieces of LWD over the five years of the permit. The expected effect of increased sedimentation is discussed above. To estimate the expected nonlethal take we calculated the number of fish in the downstream area effected by increased sedimentation.

$$T = N * D * W * FD$$

$$T = 800 * 66 \text{ m} * 3 \text{ m} * .5 \text{ —}2$$

$$T = 79200$$

T: Harm to juvenile steelhead as a result of temporary displacement, or sedimentation.

N: Number pieces of LWD to be installed

D: Downstream extent of sedimentation resulting in harm. Two-hundred feet for stream up to 100 cfs.

W: Width of the stream estimated at 3 meters.

FD: Fish density, assumed at .5 steelhead per square meter (pers. com. Bob Bilby, 2003)

ESU/Species	Life Stage	Take Activity	Overall Take	Unintentional Mortality
LCR Steelhead	Juvenile	D/S	79200	0
LCR Steelhead	Adult	D/S	500	0
LCR Chinook	Juvenile	D/S	1000	0

(D=Displacement, S=Sedimentation)

This number marks the worst case and is probably inflated. Factors reducing the actual number by an unknown factor are:

- many projects will need much less than three hours to install a piece of LWD. As a result the level of severity relating to duration and concentration of increased sedimentation may be negligible.
- the stream area affected by sedimentation originating from one stream bank may be less than the entire wetted area.
- the estimated steelhead densities may be high. John Weinheimer of the WDFW, estimated densities at less than half the density suggested by Bob Bilby (pers. com., 2003)

Supplementing Spawning Gravel

Except for two projects (8 and 10), all spawning gravel supplementation is proposed in combination with in-stream structures. For these projects no adverse effects above those discussed below are expected. For the two projects where gravel would be added to enhance a maximum of 800 feet of chum spawning channel, adverse effects include displacement of juveniles and increased sedimentation. Using the equations from above non-lethal take amount to:

$$T = 1000 \text{ m} * 3 \text{ m} * .5 \text{ m}^2$$

$$T = 1500$$

ESU/Species	Life Stage	Take Activity	Overall Take	Unintentional Mortality
LCR Steelhead	Juvenile	D/S	1500	0
LCR Steelhead	Adult	D/S	10	0
LCR Chinook	Juvenile	D/S	20	0

(D=Displacement, S=Sedimentation)

Creating in-Stream Habitat

Placing in-stream structures is described in section 1.2.8. This activity typically includes driving equipment on the bank and in the stream, excavating stream bed for placement of footer rocks, and placement of structure. The only adverse effect expected from this activity is a short-term increase in suspended sediment. Presently, FF proposes to install a maximum of 300 instream structures over the five years of the permit. For the construction of a maximum of 15 cross vanes the stream is likely to be dewatered. The expected effect of increased sedimentation is discussed above. To estimate the expected nonlethal and lethal take we calculated the number of fish in the downstream area effected by increased sedimentation or to be dewatered area.

$$T = N * D * W * FD$$

$$T = 300 * 66 \text{ m} * 3 \text{ m} * .5 \text{ m}^2$$

$$T = 79200$$

$$TL = (N * D * W * FD)M$$

$$TL = (15 * 33 \text{ m} * 3 \text{ m} * .5 \text{ m}^2) * 0.051$$

$$TL = 37.9$$

T: Harm to juvenile steelhead as a result of temporary displacement, or sedimentation.

N: Number of in-stream structures to be installed

D: Downstream extent of sedimentation resulting in harm

W: Width of the stream estimated at 3 meters.

FD: Fish density, assumed at .5 steelhead per square meter (pers. com. Bob Bilby, 2003)

TL: Lethal Take, unintentional death due to electrofishing

ESU/Species	Life Stage	Take Activity	Overall Take	Unintentional Mortality
LCR Steelhead	Juvenile	D/S/C/H/R	29700	38
LCR Steelhead	Adult	D/S/C/H/R	50	0
LCR Chinook	Juvenile	D/S/C/H/R	100	1

(D=Displacement, S=Sedimentation, C=Capture, H=Handle, and R=Release)

This number marks the worst case and is probably inflated. Factors reducing the actual number by an unknown factor are:

- many projects will need less time than three hours to install. As a result the level of severity relating to duration and concentration of increased sedimentation may be negligible.
- sedimentation impact is expected to be intermittent rather than continuous. It is expected to be at the concentration used for calculating take for the time the stream bed is excavated. After that a substantial reduction is expected. Reducing duration and concentration could reduce the severity to negligible levels.
- the estimated steelhead densities may be high. John Weinheimer of the WDFW, estimated densities at less than half the density suggested by Bob Bilby (pers. com., 2003)

Summary of Direct Effects

Table 6: Summary Take Table

ESU/Species	Life Stage	Take Activity	Overall Take	Unintentional Mortality
LCR Steelhead	Juvenile	D/S	85.848	48
LCR Steelhead	Adult	D/S	571	0
LCR Chinook	Juvenile	D/S	1.142	2

(D=Displacement, S=Sedimentation)

For the benefit of 29 restoration projects over a five year period, a maximum number of 48 juvenile steelhead and two juvenile spring chinook are expected to be killed. That equates to an annual take of 10 juvenile steelhead resulting from six projects. Conservatively estimating take in several instances involved intentionally inflated numbers (see list above). The number of dead juveniles could be much lower. Still, 48 dead juveniles (and 10 per year) is a small number as a portion of the total Lewis River steelhead outmigration. Steelhead smolt production for Cedar Creek, where most of the North Fork production occurs, averages 3600 (Table 3). Data for the East Fork were not available. Even if steelhead production in the Lewis River was

limited to the average 3,600 from Cedar Creek, 10 steelhead would be 0.3% of the run. The effect on the entire LCR evolutionary significant unit (ESU) is even smaller. We do not have data available to calculate what percentage of summer rearing chinook smolts may be killed. But, we do expect the effect to be even smaller, because the vast majority of the chinook are not in the system during construction. Thus, the percentage of the smolts that are likely to be taken is much lower than the 0.3 for the Lewis River steelhead run.

2.2.3 Indirect Effects

Indirect effects are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. Indirect effects may occur outside of the area directly affected by the action. Indirect effects may include other Federal actions that have not undergone section 7 consultation but will result from the action under consideration. These actions must be reasonably certain to occur, or they are a logical extension of the proposed action (50 CFR 402.02).

Indirect effects can affect all life stages of CR chum, LCR chinook, and LCR steelhead. It is impossible to estimate which life stages may be affected, because the timing for indirect effects is uncertain and the impacts may extend over a long period of time.

Indirect effects of the proposed action include unintended results of channel modifications such as lateral channel shifts, channel head cutting, bank erosion, and readjustment or complete failure of the cross-vanes, rock clusters, and LWD. Indirect effects from structural failure including sedimentation are expected to be limited to 600 feet downstream from the source of effect. Monitoring will help to quantify the impact from these indirect effects (see permit for annual report).

The effects on salmonids of these unintended results of channel modifications range from beneficial to detrimental depending on the type of effect, location, and timing. They all are associated with short-term adverse effects resulting from sedimentation. Lateral channel shifts can have beneficial effects for salmonids if they lead to recruitment of spawning gravel and LWD. Channel head cutting can disconnect the channel from its floodplain and reduce related habitat functions until a new equilibrium is found. Eventual failure of all in-stream structures is expected. Artificial instream structures have a limited life span; FF expects their rock structures to last 50 to 100 yrs.

The indirect effects of structure readjustment and/or failure are more likely to occur as the structures reach the end of their design life, and the design life could be reduced in time by changes in land use activities upstream of the action area. These changes include increased impervious surface and resulting changes in the winter peak flows and summer low flows (see also section 2.3. Cumulative Effects). When the cross-vane structures ultimately fail, eggs and intra-gravel fry of listed salmonids that may have spawned in the gravel immediately upstream of the cross vanes are likely to be displaced as a result of streambed head-cutting and scour. This displacement will likely result in mortality of eggs and alevins. This could occur as a result

of incremental shifting of the cross-vanes or during a catastrophic failure of one or more of the structures. However, given the design life of the cross vanes, the loss of production near the end of their design life would be significantly off-set by the potential for increased spawning production of listed fish over the life of the structures. Also, failure of an in-stream structure is not unique to artificial structures. Natural in-stream structures shift and fail as much, if not more than, the in-stream structures proposed by FF.

Aquatic insect production will be temporarily (few days to few months) diminished as a result of the direct loss of habitat from placement of the instream structures and as a result of increased suspended bedload during structure excavation and placement. Aquatic insect production is seldom affected in the long-term by minimal habitat displacement and short-term pulses of suspended sediment (Spence *et al.* 1996).

2.3 Cumulative Effects

Cumulative effects are defined as “those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation” (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Non-Federal activities of the type identified as factors for decline by NOAA Fisheries occur within the Lewis River basin. With a projected 34% increase in human population over the next 20 years (DNR 2000), these factors for decline are also expected to increase. Thus, NOAA Fisheries assumes that future private and state actions will continue within the basin, but at increasingly higher levels as population density climbs. An increase in development in the watershed will increase the risk of failure of the in-stream structures and may lead to a shorter life of the structure. An increase in development will also increase the need for programs like that proposed by FF. Riparian enhancement, fish passage improvement, and education can, counteract the adverse impacts of development to some extent. Two further activities are expected to improve salmonid habitat conditions: several state, Federal, and local programs exist that remove culvert blockages; and riparian conditions are expected to improve due to recent forest practices required for non-Federal lands. It is hard to predict the overall effect of beneficial and detrimental actions.

2.4 Conclusion

NOAA Fisheries concludes that the proposed actions are not likely to jeopardize the continued existence of LCR steelhead, LCR chinook, and CR chum. The determination of no jeopardy was based on the present status of each species, the environmental baseline for the action area, and the effects of the proposed action.

The status of chinook, steelhead, and chum salmon in the Lewis River basin is threatened. The environmental baseline is moderately degraded by past human activity including decreased

access to historic habitat, a mostly disconnected floodplain, low LWD concentrations, and poor riparian habitat. The intent of the proposed permitted activities is to improve the degraded salmonid habitat by addressing limiting factors.

NOAA Fisheries evaluated the elements of the proposed action and concluded that they are likely to contribute to improving existing conditions when added to the environmental baseline. Depending on the action and location, they are expected to result in medium- to long-term habitat benefits. The riparian habitat improvement, fish passage improvement, reconnecting off-channel habitat, nutrient enhancement, and educational component are expected to result in long-term habitat benefits for listed salmonids. The in-stream habitat improvements are expected to result in immediate and medium-term habitat improvements. These habitat benefits will outweigh the short-term adverse effects.

The short-term adverse effects include adverse effects from sedimentation, seining, temporary displacement, and small loss of riparian functions. Harm in the form of lethal take is expected to be limited, resulting only from electrofishing, capture, and handling. Lethal take of LCR juvenile steelhead resulting from direct effects is less than 0.3% of the Lewis River smolt production, much less of the LCR ESU. Lethal take of LCR juvenile chinook is close to zero. Harm is also expected to occur from indirect effects including the eventual failure of the J-hook vanes and cross-vanes, lateral channel shifts, channel head cutting, and bank erosion. The adverse effect of these events is thought to be indistinguishable from the failure of natural structures.

2.5 Reinitiation of Consultation

Consultation must be reinitiated if: The amount or extent of the specified annual take is exceeded or is expected to be exceeded; new information reveals effects of the actions that may affect the listed species in a way not previously considered; a specific action is modified in a way that causes an effect on the listed species that was not previously considered; or a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

3.0 MAGNUSON-STEVENSON FISHERY CONSERVATION AND MANAGEMENT ACT

3.1 Background

The MSA established procedures designed to identify, conserve, and enhance EFH for those species regulated under a Federal fisheries management plan. Pursuant to the MSA:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (section 305(b)(2));

- NOAA Fisheries must provide conservation recommendations for any Federal or State action that would adversely affect EFH (section 305(b)(4)(A));
- Federal agencies must provide a detailed response in writing to NOAA Fisheries within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NOAA Fisheries EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations (section 305(b)(4)(B)).

Essential Fish Habitat means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA section 3). For the purpose of interpreting this definition of EFH: Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR 600.10). Adverse effect means any impact which reduces quality and/or quantity of EFH, and may include direct (*e.g.*, contamination or physical disruption), indirect (*e.g.*, loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

An EFH consultation with NOAA Fisheries is required regarding any Federal agency action that may adversely affect EFH, including actions that occur outside EFH, such as certain upstream and upslope activities.

The objectives of this EFH consultation are to determine whether the proposed action would adversely affect designated EFH and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH.

3.2 Identification of Essential Fish Habitat

Pursuant to the MSA, the Pacific Fisheries Management Council (PFMC) has designated EFH for three species of Federally-managed Pacific salmon: chinook (*O. tshawytscha*); and coho (*O. kisutch*) (PFMC 1999). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies presently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC 1999), and longstanding, naturally-impassable barriers (*i.e.*, natural waterfalls in existence for several hundred years). Detailed descriptions and identifications of EFH for salmon are found in Appendix A of Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of potential adverse effects to these species' EFH from the proposed action is based, in part, on this information.

3.3 Proposed Actions

The proposed action and action area are detailed above in section 1.2 and 1.3 of this document. The action area includes habitats that have been designated as EFH for various life-history stages of chinook and coho salmon.

3.4 Effects of Proposed Action

As described in detail in section 2.2 of this document, the proposed action may result in short- and long-term adverse effects to habitat. These adverse effects are:

1. Temporary increases in suspended sediment as a result of in-stream work.
2. Temporary loss of aquatic insects (a prey base for listed species) due to physical loss of existing habitat at the structure placement sites and sedimentation of downstream instream habitat.
3. Habitat alteration in the form of bedload sediment transport when the instream structures fail on or before their design life. Habitat alterations in the form of lateral channel shifts, channel head cutting, and bank erosion.

3.5 Conclusion

NOAA Fisheries concludes that the proposed action would adversely affect designated EFH for chinook and coho salmon.

3.6 Essential Fish Habitat Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH. NOAA Fisheries believes that the conservation measures included as part of the proposed action are adequate to minimize the temporary increase in suspended sediment, temporary loss of aquatic insects and alteration of habitat. Because these measures are sufficient to conserve EFH, no additional conservation recommendations are necessary.

3.7 Statutory Response Requirement

Since NOAA Fisheries is not providing EFH conservation measures, no 30-day response from the action agency is required.

3.8. Supplemental Consultation

NOAA Fisheries must reinitiate EFH consultation with NOAA Fisheries if the proposed action is substantially revised in a manner that may adversely affect EFH, or if new information becomes

available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920(l)).

4.0 REFERENCES

- Ainslie, B. J., J. R. Post, A. J. Paul, 1998: Effects of Pulsed and Continuous DC Electrofishing on Juvenile Rainbow Trout. North American Journal of Fisheries Management: Vol. 18, No. 4, pp. 905–918.
- Dalbey, S. R., T. E. McMahon, and W. Fredenberg. 1996. Effect of electrofishing pulse shape and electrofishing-induced spinal injury to long-term growth and survival of wild rainbow trout. North American Journal of Fisheries Management 16:560-569.
- Bash J, C. Berman, and S. Bolton. 2001. Effects of Turbidity and Suspended Solids on Salmonids. Center for Streamside Studies, University of Washington.
- Brooks, A. P. and Brierley, G. J. 2002. Mediated Equilibrium: The influence of riparian vegetation and wood on the long-term evolution and behavior of a near-pristine river. Earth Surface Processes and Landforms Vol. 27: 343-367.
- Busby, P. J., T. C. Wainwright, G. J. Bryant, L. J. Lierheimer, R. S. Waples, F.W. Waknitz, and I. V. Lagomarsino. 1996. Status review of west coast steelhead from Washington, Idaho, Oregon, and California. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-NWFSC-27, 261 p.
- Department of Natural Resources. 2000. Changing our Water Ways: Trends in Washington's Water Systems
- Dwyer, W. P. and R. G. White,. 1997. Effect of Electroshock on Juvenile Arctic Grayling And Yellowstone Cutthroat Trout Growth 100 Days after Treatment. North American Journal of Fisheries Management 17:174-177
- Fish First. 2003. Application for a Permit to Enhance the Propagation or Survival of Threatened Lower Columbia River Steelhead (*Oncorhynchus mykiss*), Lower Columbia River Chinook (*O. tshawytscha*), and Lower Columbia River Chum (*O. keta*) Under the Endangered Species Act of 1973
- Fredenberg, W.A. 1992. Evaluation of electrofishing-induced spinal injuries resulting from field electrofishing surveys in Montana. Montana Department of Fish, Wildlife and Parks, Helena
- Hollender, B.A. and R. F. Carline. 1994. Injury to wild brook trout by backpack electrofishing. North American Journal of Fisheries Management 14:643-649.
- Johnson, O.W., W.S. Grant, R.G. Cope, K. Neely, F.W. Waknitz, and R.S. Waples. 1997. Status review of chum salmon from Washington, Oregon, and California. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-32, 280 p.

- McMichael, G.A. 1993. Examination of electrofishing injury and short-term mortality in hatchery rainbow trout. *North American Journal of Fisheries Management* 13:229-233
- McMichael, G. A. L. Fritts, and T. N. Pearsons, 1998. Electrofishing Injury to Stream Salmonids; Injury Assessment at the Sample, Reach, and Stream Scales. *North American Journal of Fisheries Management* 18:894-904.
- Myers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Wainwright, W.S. Grant, F.W. Waknitz, K. Neely, S.T. Lindley, and R.S. Waples. 1998. Status review of chinook salmon from Washington, Idaho, Oregon, and California. U.S. Department of Commerce, NOAA Technical Memo. NMFS-NWFSC-35, 443 p.
- Nehlsen W., J. E. Williams, and J. A. Lichatowich. 1991. Pacific salmon at the crossroads: Stocks at risk from California, Oregon, Idaho, and Washington. *Fisheries* 16(2):4-21.
- Newcombe C.P. and J.O.T. Jensen. 1996. Channel Suspended Sediment and Fisheries: A Synthesis for Quantitative Assessment of Risk and Impact. *North American Journal of Fisheries Management* 16:693-727
- NMFS October 29, 2001. Biological Opinion on 4 Categories of Fish Passage Restoration Activities in Washington.
- Roni, P., R.J. Beechie, R.E. Bilby, F.E. Leonetti, M.M. Ppollock, and G.R. Pess. 2002. A Review of Stream Restoration Techniques and a Hierarchical Strategy for Prioritizing Restoration in Pacific North West Watersheds. *North American Journal of Fisheries Management* 22:1-20.
- Rosgen, D. L. 2002. The Cross-Vane, W-Weir and J-Hook Vane Structures. Their Description, Design and Application for Stream Stabilization and River Restoration. Wildland Hydrology, Pagosa Springs, CO 81147 wildlandhydrology@pagosa.net
- SASSI - Salmon and Steelhead Stock Inventory. Washington Department of Fisheries *et al.* 1993
- Sharber, N. G. and S. W. Carothers. 1988. Influence of electrofishing pulse shape on spinal injuries in adult rainbow trout. *North American Journal of Fisheries Management* 8:117-122.
- Snyder, D. L. 1992 Impacts of Electrofishing on fish. Contribution number 50 of the Larval Fish Laboratory, Colorado State University, Fort Collins.
- Spence, B.C., G.A. Lomnický, R.M. Hughes, and R.P. Novitzki. 1996. An ecosystem approach to salmonid conservation. TR-4501-96-6057. ManTech Environmental Research Services Corp., Corvallis, Oregon.

Sutherland, B. June 2002. Personal Communication, Spokane Regional Service Center, NRCS, USDA.

Thompson, K. G., E. P. Bergersen, R. B. Nehring and D. C. Bowden. 1997. Long-term effects of electrofishing on growth and body condition of brown and rainbow trout. *North American Journal of Fisheries Management* 17:154-159.

U.S.Fish and Wildlife Service and National Marine Fisheries Service. March 1998. Consultation Handbook

Wade, G. Salmon and Steelhead Habitat Limiting Factors. January 2000. Water Resource Inventory Report - WRIA 27, Washington State Conservation Commission.

Weitkamp, Laurie A., Thomas C. Wainwright, Gregory J. Bryant, George B. Milner, David J. Teel, Robert G. Kope, and Robin S. Waples. 1995. Status Review of Coho Salmon from Washington, Oregon, and California.

Washington Department of Fisheries. 1973. Fisheries Resources in Southwest Washington. Prepared for Washington State Department of Ecology.

WDFW 2003. 2003-2004 Fishing Regulation Pamphlet

Appendix A - General Permit Terms and Conditions

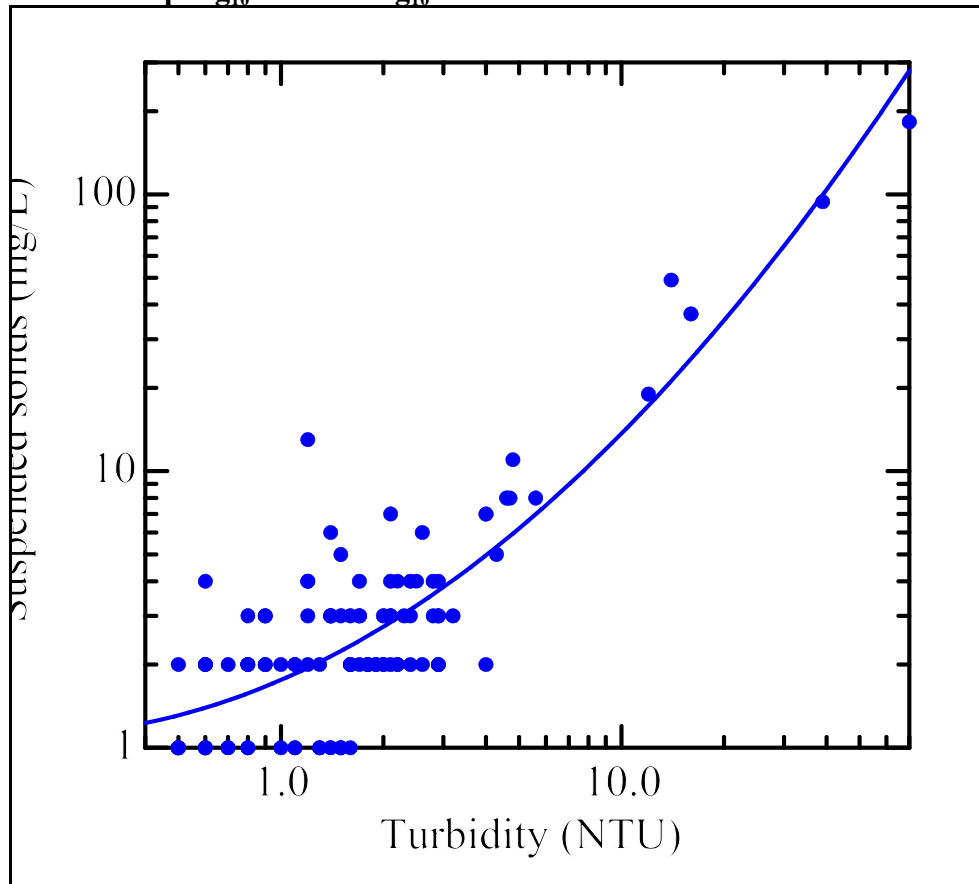
Permit Holder means Fish First as well as any employees, agents, contractors or representatives of Fish First undertaking projects under this permit.

1. The permit holder must ensure that listed species are taken only at the levels, by the means, in the areas, for the purposes stated in the permit application, and according to the terms and conditions in this permit.
2. The permit holder must not intentionally kill or cause to be killed any listed species unless the permit specifically allows intentional lethal take.
3. The permit holder must handle listed fish with extreme care and keep them in cold water to the maximum extent possible during sampling and processing procedures. When fish are transferred or held, a healthy environment must be provided; e.g., the holding units must contain adequate amounts of well-circulated water. When using gear that captures a mix of species, the permit holder must process listed fish first to minimize handling stress.
4. The permit holder must exercise care during any spawning ground surveys to avoid disturbing listed adult salmonids when they are spawning. The permit holder must avoid walking in salmon streams whenever possible, especially where listed salmonids are likely to spawn. Visual observation must be used instead of intrusive sampling methods, especially when just determining presence of anadromous fish.
5. The permit holder using backpack electrofishing equipment for fish removal must comply with NOAA Fisheries' Backpack Electrofishing Guidelines (June 2000) available at <http://www.nwr.noaa.gov/1salmon/salmesa/4ddocs/final4d/electro2000.pdf>.
6. The permit holder must notify NOAA Fisheries as soon as possible but no later than 2 days after any authorized level of take is exceeded or if such an event is likely. The permit holder must submit a written report detailing why the authorized take level was exceeded or is likely to be exceeded.
7. The person(s) actually doing the enhancement project must have a copy of this permit on hand while conducting the authorized activities.
8. The permit holder must allow any NOAA Fisheries employee or representative to accompany field personnel while they conduct the enhancement activities.

9. The permit holder must allow any NOAA Fisheries employee or representative to inspect any records or facilities related to the permit activities.
10. The permit holder may not transfer or assign this permit to any other person as defined in Section 3(12) of the ESA. This permit ceases to be in effect if transferred or assigned to any other person without NOAA Fisheries' authorization.
11. NOAA Fisheries may amend the provisions of this permit after giving the permit holder reasonable notice of the amendment.
12. The permit holder must obtain all other Federal, state, and local permits/authorizations needed for the enhancement activities.
13. On or before November 31 of every year, the permit holder must submit to NOAA Fisheries an annual report in the prescribed form (see attached annual reporting form) describing the enhancement activities, the number of listed fish taken and the location, the type of take, the take dates, the sediment monitoring data, and the longitudinal profiles (in years applicable). Falsifying annual reports or permit records is a violation of this permit.
14. If the permit holder violates any permit term or condition they will be subject to any and all penalties provided by the ESA. NOAA Fisheries may revoke this permit if the authorized activities are not conducted in compliance with the permit and the requirements of the ESA or if NOAA Fisheries determines that its ESA section 10(d) findings are no longer valid.

Appendix B: Regression Graph \log_{10} NTU vs \log_{10} SS

Relationship \log_{10} NTU vs \log_{10} SS



Appendix C: Average Severity of Ill Effect Scores Matrix from Newcombe and Jensen, 1996

Average severity of ill effect scores (calculated) Juvenile and Adult Salmonids

mg SS/l						
2981	7	8	8	9	9	10
1097	6	7	7	8	9	9
403	5	6	7	7	8	9
148	5	5	6	7	7	8
55	4	5	5	6	6	7
20	3	4	4	5	6	6
7	3	3	4	4	5	6
3	2	2	3	4	4	5
1	1	2	2	3	3	4
	1	3	7	1	2	6
	Hours			Days		

Underlying this table is a linear regression.

Appendix D: Suspended Solids East Fork Lewis River at Dollar Corner

Data from Department of Ecology

COUNTY: Clark

River Mile: 10.2

DIRECTIONS:

LOCATED AT THE LEWIS RIVER BOTTOM ROAD BRIDGE, APPROXIMATELY THREE MILES NORTHWEST OF BATTLE GROUND, AND APPROXIMATELY 2.75 MILES NORTH AND EAST OF DOLLAR CORNER PAST KING CORNER, .6 MILE ABOVE MILL CREEK AT DAYBREAK COUNTY PARK

Date	StaName	Suspended Solids	Turbidity
June 13, 1978	EF Lewis R nr Dollar Corner	2	1
July 25, 1978	EF Lewis R nr Dollar Corner	1	1
August 15, 1978	EF Lewis R nr Dollar Corner	2	1
September 6, 1978	EF Lewis R nr Dollar Corner	2	1
October 10, 1978	EF Lewis R nr Dollar Corner	4	1
June 19, 1979	EF Lewis R nr Dollar Corner	1	1
July 10, 1979	EF Lewis R nr Dollar Corner	4	2
August 7, 1979	EF Lewis R nr Dollar Corner	3	2
September 5, 1979	EF Lewis R nr Dollar Corner	2	2
October 9, 1979	EF Lewis R nr Dollar Corner	2	1
June 24, 1980	EF Lewis R nr Dollar Corner	4	2
July 15, 1980	EF Lewis R nr Dollar Corner	1	1
August 26, 1980	EF Lewis R nr Dollar Corner	2	1
September 23, 1980	EF Lewis R nr Dollar Corner	4	1
October 28, 1980	EF Lewis R nr Dollar Corner	6	1
June 16, 1981	EF Lewis R nr Dollar Corner	4	2
July 28, 1981	EF Lewis R nr Dollar Corner	1	1
August 18, 1981	EF Lewis R nr Dollar Corner	1	1
September 15, 1981	EF Lewis R nr Dollar Corner	1	2
October 13, 1981	EF Lewis R nr Dollar Corner	2	5
June 15, 1982	EF Lewis R nr Dollar Corner	4	1
July 20, 1982	EF Lewis R nr Dollar Corner	1	1
August 17, 1982	EF Lewis R nr Dollar Corner	2	1
September 21, 1982	EF Lewis R nr Dollar Corner	2	3
October 12, 1982	EF Lewis R nr Dollar Corner	5	1
June 14, 1983	EF Lewis R nr Dollar Corner	2	2
July 12, 1983	EF Lewis R nr Dollar Corner	1	1
August 9, 1983	EF Lewis R nr Dollar Corner	2	1
September 7, 1983	EF Lewis R nr Dollar Corner	1	1
October 4, 1983	EF Lewis R nr Dollar Corner	1	1
June 26, 1984	EF Lewis R nr Dollar Corner	3	2
July 24, 1984	EF Lewis R nr Dollar Corner	1	1
August 28, 1984	EF Lewis R nr Dollar Corner	1	1
September 26, 1984	EF Lewis R nr Dollar Corner	2	2

October 30, 1984	EF Lewis R nr Dollar Corner	2	2
June 24, 1986	EF Lewis R nr Dollar Corner	12	1
July 29, 1986	EF Lewis R nr Dollar Corner	3	1
September 23, 1986	EF Lewis R nr Dollar Corner	6	1
October 28, 1986	EF Lewis R nr Dollar Corner	10	2
June 22, 1987	EF Lewis R nr Dollar Corner	3	1
July 28, 1987	EF Lewis R nr Dollar Corner	1	1
August 25, 1987	EF Lewis R nr Dollar Corner	3	1
September 29, 1987	EF Lewis R nr Dollar Corner	2	1
October 27, 1987	EF Lewis R nr Dollar Corner	2	2
June 28, 1988	EF Lewis R nr Dollar Corner	3	1
July 26, 1988	EF Lewis R nr Dollar Corner	2	1
August 23, 1988	EF Lewis R nr Dollar Corner	1	1
September 27, 1988	EF Lewis R nr Dollar Corner	11	1
October 25, 1988	EF Lewis R nr Dollar Corner	2	1
June 27, 1989	EF Lewis R nr Dollar Corner	2	0.7
July 25, 1989	EF Lewis R nr Dollar Corner	4	0.6
August 29, 1989	EF Lewis R nr Dollar Corner	2	0.5
September 26, 1989	EF Lewis R nr Dollar Corner	5	0.7
October 24, 1989	EF Lewis R nr Dollar Corner	6	2.2
June 26, 1990	EF Lewis R nr Dollar Corner	2	1
July 30, 1990	EF Lewis R nr Dollar Corner	1	1
August 28, 1990	EF Lewis R nr Dollar Corner	1	1
September 25, 1990	EF Lewis R nr Dollar Corner	2	1
October 30, 1990	EF Lewis R nr Dollar Corner	4	1.5
June 25, 1991	EF Lewis R nr Dollar Corner	2	1.9
July 30, 1991	EF Lewis R nr Dollar Corner	1	1.2
August 27, 1991	EF Lewis R nr Dollar Corner	1	0.4
September 24, 1991	EF Lewis R nr Dollar Corner	1	1
October 29, 1991	EF Lewis R nr Dollar Corner	1	1
June 23, 1992	EF Lewis R nr Dollar Corner	2	0.5
July 28, 1992	EF Lewis R nr Dollar Corner	5	2.7
August 25, 1992	EF Lewis R nr Dollar Corner	1	1.4
September 29, 1992	EF Lewis R nr Dollar Corner	1	1.5
October 25, 1994	EF Lewis R nr Dollar Corner	1	0.5
June 28, 1995	EF Lewis R nr Dollar Corner	1	0.7
July 26, 1995	EF Lewis R nr Dollar Corner	2	0.6
August 30, 1995	EF Lewis R nr Dollar Corner	1	0.5
September 27, 1995	EF Lewis R nr Dollar Corner	37	16
October 25, 1995	EF Lewis R nr Dollar Corner	1	1.1
June 25, 1996	EF Lewis R nr Dollar Corner	3	2.8
July 31, 1996	EF Lewis R nr Dollar Corner	3	1.4
August 28, 1996	EF Lewis R nr Dollar Corner	1	0.6
September 25, 1996	EF Lewis R nr Dollar Corner	2	0.6
October 30, 1996	EF Lewis R nr Dollar Corner	2	2.2
June 25, 1997	EF Lewis R nr Dollar Corner	2	4
July 28, 1997	EF Lewis R nr Dollar Corner	3	1.2
August 25, 1997	EF Lewis R nr Dollar Corner	3	1.4
September 28, 1997	EF Lewis R nr Dollar Corner	1	1
October 28, 1997	EF Lewis R nr Dollar Corner	2	2.1

June 29, 1998	EF Lewis R nr Dollar Corner	4	1.2
July 28, 1998	EF Lewis R nr Dollar Corner	4	1.2
August 25, 1998	EF Lewis R nr Dollar Corner	4	0.6
September 29, 1998	EF Lewis R nr Dollar Corner	2	0.5
October 28, 1998	EF Lewis R nr Dollar Corner	2	0.9
June 29, 1999	EF Lewis R nr Dollar Corner	1	0.7
July 28, 1999	EF Lewis R nr Dollar Corner	3	0.9
August 25, 1999	EF Lewis R nr Dollar Corner	2	0.6
September 29, 1999	EF Lewis R nr Dollar Corner	1	0.5
October 26, 1999	EF Lewis R nr Dollar Corner	3	1.5
June 27, 2000	EF Lewis R nr Dollar Corner	5	1.5
July 25, 2000	EF Lewis R nr Dollar Corner	3	0.8
August 29, 2000	EF Lewis R nr Dollar Corner	2	0.8
September 26, 2000	EF Lewis R nr Dollar Corner	1	0.6
October 25, 2000	EF Lewis R nr Dollar Corner	2	0.8
June 27, 2001	EF Lewis R nr Dollar Corner	4	2.5
July 25, 2001	EF Lewis R nr Dollar Corner	2	1.3
August 29, 2001	EF Lewis R nr Dollar Corner	2	1.1
September 26, 2001	EF Lewis R nr Dollar Corner	3	2.4
October 31, 2001	EF Lewis R nr Dollar Corner	49	14
June 26, 2002	EF Lewis R nr Dollar Corner	1	0.6
July 31, 2002	EF Lewis R nr Dollar Corner	2	0.7
August 28, 2002	EF Lewis R nr Dollar Corner	1	0.7
September 25, 2002	EF Lewis R nr Dollar Corner	1	0.6
October 30, 2002	EF Lewis R nr Dollar Corner	1	0.5

Averages

3.24770642
2

1.49541284

